

## SUMMARY OF THE MAIA WORKING CONFERENCE

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### 1. Introduction

From November 30 to December 2, 1998, the Mid-Atlantic Integrated Assessment (MAIA) held a Working Conference in Baltimore, Maryland (USA), to present its results to scientists, environmental managers, and the public. It also solicited feedback on the usefulness of the MAIA program's activities, as well as suggestions on needs or changes to its program. The conference addressed these questions:

- What have we accomplished?
- What is missing?
- What should we do differently?
- Has the MAIA program been useful, and will it be useful in the future?

The format was designed to help the participants exchange information. Each presenter concluded with a "take-home message," which collectively formed the starting points for guided discussions after each of the four Theme Sessions (Terrestrial, Aquatic, Information Management, and Multi-resource). These discussions addressed all four questions, and summarized and recorded the key points from each Theme Session.

During the last day's "Open Working Sessions," the attendees divided into three groups to discuss the MAIA program's usefulness so far. Each group developed recommendations for advancing the MAIA program over the next decade, which may be incorporated into future management and scientific actions in the Mid-Atlantic region.

This report summarizes the results of the conference.

## 2. Presentations by Plenary Speakers

Plenary speakers were senior managers from various parts of EPA. They included Tom DeMoss, MAIA Team Leader; Tom Voltaggio, Deputy Regional Administrator of Region 3; Noreen Noonan, Assistant Administrator for Research and Development; David Ziegele, Director of Planning, Analysis, and Accountability; and Patricia Bradley, Research Program Manager, MAIA Team.

Mr. DeMoss outlined the MAIA program's components:

- Improved environmental monitoring
- Research on indicators
- Comprehensive assessments, including risk management
- Targeted ecological restoration
- Communicating scientific results

He then summarized the completed products:

- MAIA-wide Landuse/Landcover Map
- Landscape Atlas (USEPA 1997)
- Condition of the Mid-Atlantic Estuaries (USEPA 1998)
- *Pesticides in Surface Water of the Mid-Atlantic Region (USGS 1997a)*
- *Nitrate and Selected Pesticides in Groundwater in the Mid-Atlantic Region (USGS 1997b)*
- Inventory of Environmental Monitoring Programs (Jackson and Gant, 1998)

Finally, Mr. DeMoss discussed a few products that are still being developed:

- State of the Mid-Atlantic Streams
- State Stream Assessments
- Integrated Field Monitoring (Estuaries and Streams)
- State of the Mid-Atlantic Forests
- Integrated Regional Report Card

Mr. Voltaggio discussed Region 3's highest-priority environmental issues and how information from the MAIA program has helped deal with them:

- Chesapeake Bay and other estuaries
- Effects of acidification
- Ozone
- Cities and urban environments

- Climate change
- Mountaintop Removal/Valley Fill

Dr. Noonan described the Office of Research and Development's emphasis on understanding comparative risks to ecological resources. She summarized the ORD products produced by the MAIA program to date, including ORD's report on the *Condition of the Mid-Atlantic Estuaries*. Dr. Noonan described ORD's work that is relevant to the MAIA program, including these three specific projects:

- The Regional Vulnerability Assessment (ReVA), a new program that will develop comparative risk assessments specifically for major stressors in the Mid-Atlantic.
- The EPA Global Change Program, which will begin to assess the risks that a changing climate will pose to humans and ecosystems in the Mid-Atlantic region. A partnership with Pennsylvania State University will allow this work to build on EMAP's data.
- The Ecosystem Restoration Program, which will work with the MAIA program's partners to restore riparian habitats and the biological communities that depend on them.

She also described how the EMAP Western Pilot Study is being planned with 12 western states and the respective EPA Regional offices. It will determine whether the MAIA program methods can be applied to these regions.

Mr. Ziegele described the Government Performance and Results Act (GPRA) of 1993, which challenges federal agencies to be accountable for setting goals, getting results, measuring results against goals, reporting progress publicly, and focusing on results, quality, and customer service. He pointed out that the MAIA program can be the prototype for a nationally consistent methodology for assessing the health of ecosystems. The MAIA program can measure its progress towards meeting environmental outcome-based objectives and sub-objectives, and influence the next generation of national strategic commitments. The MAIA program's direct links to the strategic plan, the resources, and the outcomes encourage it to be fiscally accountable.

Ms. Bradley described the MAIA program's communication strategy, emphasizing that the ultimate goal is to provide information that is used in the decision-making process. The MAIA program results and information must satisfy the clients' needs, convey important information relevant to their assessment questions and issues, and be understandable and useful in making environmental management decisions.

She also pointed out that multiple audiences are interested in the information that comes from the MAIA program, each bringing its own perspective and background. The MAIA program is using the pioneering work of Tufte (1983) to de-

velop ways to format information and present in a clear manner. The MAIA program will also develop and implement multimedia approaches to presenting information. It will determine how different audiences responded to the information presented in previous assessments, how they used that information to make decisions, and how the MAIA program can communicate better.

### 3. Theme Sessions

#### 3.1 TERRESTRIAL

The MAIA program is just beginning to work on terrestrial resources. So far it has primarily emphasized forests, and secondarily agricultural and urban ecosystems. The session on terrestrial ecosystems considered forestry, indicators of biodiversity (amphibians and birds), landscape assessments, the socio-economics of forestry, and effects of forests on aquatic ecosystems.

The reports showed that forests in the MAIA region are generally healthy, but are affected by a variety of stressors, some of which can be of great concern. The greatest threats to these forests are land-use changes that fragment the forest and spread exotic insects and disease. Although forests are also affected by air pollution, such effects in the MAIA region remain uncertain. A "Condition of the Forests" report that describes these results will be prepared in 2000 and will be followed by more focused technical reports.

Because biodiversity is so important to the vitality of forests, several presenters described how birds and amphibians can indicate the condition of forests. The "bird community index" method organizes species of birds into guilds that correlate with ecological integrity. The data in the North American Breeding Bird Survey could be integrated with the "bird community index" to estimate spatial and temporal changes in community attributes of forest-breeding birds across the region. A parallel effort to the North American Breeding Bird Survey is underway to utilize volunteers in a large-scale probabilistic survey of amphibians in the MAIA region. Lastly, methodological issues relevant to monitoring amphibians in the Shenandoah National Park were discussed.

One report assessed aquatic resources and how forests affect them relative to other land covers. It concluded that in the MAIA region, agriculture affects water quality more than forests do.

Forests in much of the MAIA region are a vital component of local economies and provide jobs for many residents. The presentation on socioeconomic focused on efforts to develop systems for monitoring the ways in which changes in forests affect human welfare. Its key components were: 1) an analysis of changes in the distributions of the human population and the industries that depend on forest resources, 2) an assessment of the economic contributions of the forest-based manufacturing sector by analyzing trends in employment and income from the

wood-product sector, and 3) a study of supply and demand for major types of forest recreational settings and activities in the MAIA region.

Urban and agricultural ecosystems are also important components of terrestrial systems. Although the MAIA program has only begun to explore these systems, it recognizes that they must be included in any integrated assessment—the ultimate goal of the MAIA program effort. The Baltimore Long Term Ecological Research site should provide a focus for understanding urban ecosystems in the MAIA region. The collaboration with Maryland's Department of Agriculture shows promise for addressing the condition of agro-ecosystems.

Lessons learned from MAIA should be applied to future regional assessments. The more relevant that the MAIA program's information appears to potential partners, the more likely they will be to join the program. The group recommended that:

- Methods must be developed for “scaling” information up or down (from regional to local, and vice versa), which will make it more attractive to potential partners.
- Methods for collecting data in the field need to be harmonized as much as possible, as do the systems for monitoring and inventorying. There is already significant progress along these lines. By collaborating with the U.S. Forest Service and various State Forestry Agencies, the Forest Health Monitoring (FHM) program is collecting a robust set of ecological information. FHM is also merging its plot component with that of the Forest Inventory and Analysis (FIA) program, in order to provide more efficiency and better information. The Forest Service and the Natural Resources Conservation Service are exploring ways to link FIA/FHM with the National Resources Inventory.
- Indicators of biodiversity need to be further explored, verified, and then used to monitor birds and amphibians. Indicators for other species also may need to be incorporated.
- Landscape assessments will provide critical information in the years ahead. More progress is needed to develop classes of vegetation that cross political boundaries, and to improve groundtruthing and quality-assurance.

The group agreed that the MAIA program has been very helpful in getting environmental resource agencies to work across media, across scales, and with each other. The MAIA program will continue to emphasize such collaboration.

### 3.2 AQUATIC

The theme session on aquatic systems covered subjects from headwater streams to estuaries. Talks on streams considered sampling design, ecological conditions,

and water quality. Other talks dealt with groundwater quality, macroinvertebrates in nontidal streams, and trends of contaminants in terrestrial invertebrates associated with estuaries. Two talks covered large-scale monitoring of estuaries, one on integrated monitoring of estuaries and the other on information in the *Condition of Mid-Atlantic Estuaries Report*. Another presentation described how Maryland's Clean Water Action Plan had used data from various kinds of aquatic systems to assess conditions of watersheds. The session concluded by presenting plans for future aquatic programs.

Several important messages emerged from this session. The strongest was the need to develop and implement methods of collecting and analyzing data that are compatible enough across state lines to characterize regional resources. This process would also include developing a core suite of indicators. The group also emphasized the need to collect consistent long-term data at appropriate temporal and spatial scales. The attendees agreed to more fully integrate assessment of habitat conditions into programs for protecting and restoring resources. The group further recognized that we have a limited understanding of contaminant fate and transport in estuarine systems.

The group recognized that programs for assessing aquatic ecosystems still lack several basic capabilities, foremost among which are monitoring and analyzing long-term trends. The group noted that there was no clear framework or associated organizational structure to assess regional or interstate watersheds. They also recognized that future efforts by federal agencies would have to provide a mechanism for states to take ownership of the important components of these programs because many or most of the personnel required for collecting and storing the data are working in state agencies. The group noted that several types of aquatic resources are still insufficiently monitored, such as tidal streams, lakes, reservoirs, and wetlands. Also noted was the need to increase the monitoring of atmospheric deposition, loadings of pathogens into lakes and reservoirs from sediments, and potential impacts on human health and wetlands.

The group also produced several important recommendations on restructuring aquatic assessment programs. Although most of the attendees in this session came from federal agencies, they nevertheless expressed strong sentiment that states should be made significant partners in regional programs. The attendees recognized that states who do most of the work within their borders must be funded accordingly. The funds could be federal or a combination of federal and redirected state funds. The group also agreed that regional assessments need to be designed to add appreciable value to state programs by providing answers or information that is useful to state-scale assessments. Nearly everyone agreed that states could also benefit greatly from packaging and distributing digital databases generated by federal agencies during regional and national assessments.

The attendees agreed that the MAIA and other regional assessments had demonstrated several concepts useful in assessing aquatic systems. The first was that biological indicators are valuable tools for assessing regions. Among other things,

the group thought that biological indicators would help in adopting consistent assessment methodologies. The group also thought that probabilistic sampling programs were a useful way to reduce costs. Although probabilistic sampling is not always appropriate for answering management or assessment questions, it generally requires fewer sites than deterministic designs do, especially for answering questions about the state of a resource.

### 3.3 INFORMATION MANAGEMENT

The session on information management described the MAIA program's requirements, articulated a vision, evaluated continuing efforts in related programs that could be incorporated, and planned some next steps. The session consisted of four oral presentations that led into a panel discussion, a poster session, and an open discussion. Panel members represented various organizations collecting and using environmental information in the Mid-Atlantic region. They included Lowell Bahner, Chesapeake Bay Program; Patricia Bradley, MAIA Team; Al Morris, EPA Region 3; Paul Kinder, Canaan Valley Institute; Tom Mace, EPA Office of Research and Development; Stephen Hale, EMAP; Anthon Allred, Maryland Dept. of Natural Resources; Tim Foresman, Univ. of Maryland; Jeffrey Rosen, Technology Planning & Management Corp; Shara Howie, The Nature Conservancy (by email); and Walt Galloway, EPA Office of Research and Development (facilitator). The panel and open discussion addressed the following questions:

1. What is the need to share data within the MAIA region?
2. How can we integrate data from different data systems?
3. What barriers exist to sharing and integrating data?
4. How can we overcome these barriers?
5. Do we within the MAIA program share a common vision for managing its data?
6. Who will potentially use the MAIA program's regional data management system, and what will they need?
7. What form should the MAIA program's information management system take?
8. What are the next steps toward achieving the vision?

The MAIA program needs multiple sources of data to answer its assessment questions and successfully assess regional environments. No single organization can conduct wall-to-wall multi-disciplinary studies, nor can one organization maintain a comprehensive data management system for an area as large as the Mid-Atlantic. Thus, region-wide comparisons require data to be shared through distributed information systems.

Watersheds frequently cross political boundaries. Although some groups focus on one or another boundary, there is a need to integrate across both. In addition, there is a desire to develop generalized global data for taxa and natural

communities in order to guide conservation actions and decisions. This includes information on habitats, threats, global conservation status, and management.

There is a need for information that is cross-referenced spatially and temporally and is easily available. The form of data will vary (raw data, processed data, environmental indicators, publications, press releases, and fact sheets) to meet the different needs of different users. The level of detail will range from specific sites to regional summaries. Because smaller groups can find it hard to get the data they need, even though they may have significant data sets of their own, larger organizations can help them with data that may be expensive to acquire and difficult to manage. Community ownership of data leads to enhanced stewardship. The act of mobilizing data for outside users often improves the exchange of data within an organization. There is also the consideration that data collected with public funds must be made available to the public, and that data sharing minimizes redundancy and saves money.

When integrating data from multiple systems, one must always consider the study design, the sampling methods, and the quality assurance of the original studies. Metadata and a core of common standards are essential. Common sampling procedures and data management standards make it easier to integrate data. For example, a standardized taxonomy based on the Integrated Taxonomic Information System (<http://www.itis.usda.gov/>) would help integrate species data. Once integrated, data products should be stored along with the methods used to integrate them, for future reference and to reduce redundancy. A database with a common data dictionary (e.g., MAIA-Estuaries Summary Database) works well for programs with restricted scopes.

Free exchange of data still faces a number of significant obstacles such as inadequate funding, inadequate metadata, and different codes, standards, and data formats. Social issues concerning data ownership and publishing may also arise, and there may be few incentives for sharing data. Another serious barrier is the lack of full and open data sharing, and the current political issue regarding "copyrighting" of data, which will further complicate the problem. To ensure confidentiality, data are sometimes produced or collected under an agreement not to release accurate locational information. Some groups fear unilateral enforcement actions if certain data are fully accessible. All of the above obstacles are exacerbated by the multiple political jurisdictions and "turfs" involved.

Some state systems are not adequately protected against hackers (by a "firewall") and so do not want to open their sites to the Internet. Data sets may not be accessible by a network if they reside only in personal computers or on paper. Then there is the difficulty of finding data: some are not entered into data directories, and common search standards (e.g., Z39.50 protocol) are not currently supported on EPA's public access web site.

There is a need for a regional entity, with a common vision for data management, that is larger and more inclusive than any geographic initiative in the MAIA region. The MAIA program could provide a way of integrating data from many



sources. The combined geographical initiatives in the MAIA region (Chesapeake Bay Program, Canaan Valley Institute, Delaware River Basin Commission, Coastal Bays, National Estuaries Programs), which cover almost the entire MAIA region, are interested in a larger entity that would help them share data among themselves and with neighboring initiatives. An Executive Coordinating Committee of all MAIA's geographic initiatives should be formed to plan the next steps, identify the stakeholders, and develop a memorandum of understanding. This group would help decide what to develop, where to house it, and how to maintain it. The MAIA program could identify one or two important issues and set up well-funded data management systems to demonstrate their usefulness.

It is important for the MAIA program to identify the potential users of its regional data system and their needs as it begins to develop the system. The users to target are researchers and information intermediaries/specialists (who will use the system intensively), the public, and public schools (that will use the highly digested data). The system should present the data on a web site that has nested levels of access, so that scientists and the public can enter the framework at various levels and proceed to reports, maps, and data as needed. The system will need Internet access, distribution of CD ROMs, online search engines, data subsetting, data analysis and interpretation, and data format conversion. The system will need at least: 1) a data directory to help locate data, 2) data sets on the Internet or on CDs so that data can always be obtained, and 3) metadata to help users understand the data and use them properly.

The MAIA program is not a monitoring program that collects original data, it will not duplicate any existing data system, and it will not store original raw data (these are stored and made available by the data collectors). For example, the data collected by ORD in 1997 and 1998 supplemented ongoing monitoring programs in the MAIA region; these data are maintained and made available on the Internet by the ORD data collectors.

The MAIA program should provide a way to integrate data that are being collected by various sources. It should provide products that are larger in scale than any individual program, watershed, political entity, or geographic initiative. The procedure might include helping entities to obtain others' data, assessing regional environments, producing value-added data products, and so on. The MAIA program must find a way to draw out data needed for assessments and convert them into a common model that will make it easier to organize and get data. The MAIA program should focus on tools for the broad scale, which could include a directory of data directories, a data clearinghouse, a data warehouse, and the existing inventory of monitoring programs.

### 3.3.1 *Communications*

The complexity of scientific data often limits its usefulness as a tool for affecting policy. In the courtroom, the meeting room, the Congress, or the voting booth, the messages carried by scientific evidence are effective only when they are conveyed

clearly and simply. Unfortunately, the key evidence used by EPA to protect the environment is often terribly complex. The need to display our intricate data in ways that the public can grasp has become urgent enough that we need better ways to help the non-scientist understand the science. The need for clear and understandable information increases when one considers the growing variety of media available for carrying our message. Written press releases are now only the tip of an iceberg that includes TV, targeted video productions, web sites, and related Internet links. Audiences will more easily and quickly understand technical information if the following presentation guidelines are used:

- Target your information. Is your objective to educate, to inform, or to persuade someone to make a decision or take an action? Your approach and content will vary with your goal.
- Emphasize comparisons and show trends. Use data to compare the past to the present, the present to the future, or conditions before an action to after it. Is the situation getting better or worse?
- Use headlines. Provide a succinct headline that interprets your primary point and follows from the data and the graphics.
- Focus on findings and implications. Managers need information that can influence their decisions. Do not present methodology and approaches to managers—publish them in scientific, peer-reviewed journal articles.
- Provide geographic context. Where did the data come from? Over how large an area? When? Is the area unique or is it representative of other areas?
- Include recommendations. Discuss what can or should be done, why it should be done, what the expected results will be, and when they can expect to be achieved.
- Use graphics. A picture is worth a thousand words. Visual comparisons are grasped more quickly and easily than pages of text or numbers.

### 3.4 MULTI-RESOURCE

The Multi-Resource Theme Session included several topics that crossed traditional disciplinary lines. One focus of the session was landscape sciences and their applications to environmental research. This new approach seems to have enormous potential for environmental research and management. The presentations provided information about landscape characterization (land cover/land use) and landscape ecology. One application of landscape sciences that attracted attention was using it in strategic planning for natural resources. Multimedia modeling initiatives were included because these projects are needed to develop a compatible, flexible platform for future models, including consistent interpretation among the models and approaches. All ecological models should include multi-resource and

multiscale components, and “confidence limits” should be clearly stated when performing data analyses and communicating results.

Another area of emphasis for this session was the role of economics in environmental assessment and decision-making. This topic was included because it was recognized that environmental managers must combine economic information with scientific data as they make decisions (for example, via cost benefit analyses). Several presentations dealt with modeling the valuation of goods and services that are provided by ecological systems. Economic indicators associated with conditions of ecosystems were also discussed.

Once assessments have identified problems in a regional environment, the environment needs to be restored. Although most of the discussions on restoration focused on restoring forested riparian buffers, the presentations were diverse. One focused strongly on the science, another on activities of a non-governmental environmental organization.

In summary, contemporary decisions require useful information, which the MAIA program can provide by overseeing and integrating the many activities in the Mid-Atlantic region. Approaches that wish to be accepted need to build from the simple to the complex and to provide short-term utility as well as long term solutions.

#### **4. Open Working Sessions**

The attendees divided into three groups that engaged in facilitated discussion directed toward answering these two questions:

- From all you have heard, which two or three things could we do to most advance the MAIA Program in the next ten years?
- Which specific actions would you recommend to do those two or three things?

The group’s recommendations can be placed into three broad areas: organizational issues, technical issues, and customer-service issues.

##### **4.1 ORGANIZATIONAL ISSUES**

The MAIA program needs to provide the organizational structure for assessing regions. It should identify and agree upon the roles and responsibilities of its partners. It should continue to reach out to and build partnerships with additional groups such as community groups, environmental groups, other affected groups, county organizations, non-governmental organizations, and watershed organizations. To facilitate these partnerships, the MAIA program should produce a “How To” manual and provide training in using MAIA’s tools (indicators, monitoring designs, assessment approaches, etc.).

The MAIA program should emphasize integration up front. Integration issues include developing common monitoring/modeling approaches for ecological resources, across resources, and across disciplines; forming a multi-disciplinary team that incorporates disciplines outside EPA's traditional areas; and getting a broad range of stakeholders to participate in developing questions to be investigated.

EPA and the federal partners must demonstrate long-term commitment to this new way of doing business. This includes adequately staffing the MAIA program with staff from the various partners, and providing resources for the state and local governments to test out new indicators, implement comprehensive monitoring programs, and provide documented and accessible data.

The MAIA program needs to understand the needs of the state programs (e.g., Total Maximum Daily Loads) and how various MAIA program activities will support them. To achieve a "buy-in," the MAIA program must be able to clarify the benefits to the partners in terms that are meaningful to them. The MAIA program should also actively support and participate in similar efforts in other regions, transferring the lessons learned in MAIA.

#### 4.2 TECHNICAL ISSUES

Many technical issues are not being addressed by state and federal programs. The MAIA program, in its role as the synthesizing regional organization, could deal with these issues. Two regional issues are key to MAIA's success. One issue is the need to foster and organize integrated assessments. Integration should be multi-resource (aquatic, terrestrial, landscape); multiscale (local to regional, ecological, and political), with linkages between scales; and multi-disciplinary (ecology, socio-economics, human health). The other issue is the need to institutionalize long-term monitoring at all levels. Monitoring should include trends, combine probability-based sampling with targeted sampling, use a consensus approach to standardize methods of collecting and analyzing; and begin to cover resources not currently being monitored effectively (wetlands, tidal rivers, lakes and reservoirs). For the monitoring program to truly become institutionalized, the states must have ownership, and the federal agencies must support their efforts.

In support of the integrated assessments and monitoring, the MAIA program should support research and development of better biological and landscape-level indicators, and issues of scale should be addressed. An immediate need is to update the Multi-Resolution Land Characteristics Consortium (MRLC) land-cover product in 2000. Another area of research emphasis should be trends analysis and vulnerability assessments—to provide "what if" scenarios for regional and local managers.

#### 4.3 INFORMATION NEEDS AND CUSTOMER-SERVICE ISSUES

A measure of the MAIA program's success will be responsiveness to its customers. As a starting point, the MAIA program needs to clearly identify its primary

customers and develop appropriate means for providing feedback to them. Feedback should include information on how MAIA program data and information can be used; how it has been used (from identification of a problem through the integrated effort that led to management decisions which led to improvement in resources); and a reporting process that quantitatively and qualitatively measures environmental improvements.

The MAIA program should develop and implement a communication plan and a data-management plan. The plan should include marketing, outreach, and training. In addition, research should be conducted to determine the types of information that customers need in order to make their management and regulatory decisions. After this research is completed, the necessary data, information, and analytical tools should be targeted to meet the needs of the customers.

The MAIA program should make information available on the Internet. Data should be easy to find and easy to get in a timely manner. The MAIA program should also capture, maintain, and disseminate value-added information at user-appropriate levels. And, because it operates at the Regional level, the MAIA program should continue to emphasize and facilitate data intercomparability.

Finally, the MAIA program should develop continuous, active feedback mechanisms, and adjust products and tools to meet the changing needs of customers.

## **5. The Strategic Planning Panel**

The final panel was composed of mid-level environmental managers who represented a cross-section of state, federal, and non-governmental organizations. Panel members were Arthur Ray, Deputy Secretary of the Maryland Department of the Environment; Stanley Laskowski, Director of the Environmental Services Division of the U.S. Environmental Protection Agency (Region 3); and Fran Flannigan, Executive Director of the Alliance for the Chesapeake.

This panel was intended to provide the environmental managers' perspective on the usefulness of information presented during the conference, and to discuss some of the environmental managers' concerns and needs. Mr. Laskowski described how understanding of environmental conditions provided by the MAIA program has influenced Region 3's strategic planning and management decisions. He emphasized the importance of communicating understandable data to outside customers such as the public, county planners, and state and local governments. He also described how the MAIA program could influence 305(b) reporting and the design of monitoring.

Mr. Ray described Maryland's Watershed Management Framework, an integrated approach that could incorporate information from the MAIA program and build upon it. He emphasized that the key to managing the environment is explain-

ing the reasons for decisions to the public. He also discussed why issues of environmental justice are important to decision-makers.

Ms. Flannigan pointed out how important it is to interpret information in ways that allow the educated public to understand it and incorporate it into their decision-making processes. She emphasized that although the regional picture is important, citizens are primarily interested in local questions. She recommended that the MAIA program first determine how its information can be used by communities, and then use maps and other visual aids in local presentations.

The panelists then responded to a series of questions.

- Who is responsible for communicating scientific findings to the lay public? The entire environmental community is responsible, but some persons can communicate better than others. Partnerships can capitalize on different participants' strengths in science and in interpretation.
- Do the customers really want integration, or rather, information to evaluate their own local issue? Scientists do not necessarily need to provide integrated answers, only enough information about items of concern to allow the stakeholders to form their own integrated opinions.
- How does technical information fit into the larger set of what you use to make decisions? EPA may not be required to provide it all, but rather should focus on providing technical information in a manner that allows stakeholders to integrate those factors into their other considerations.
- How has the public's environmental IQ changed over the years? Although the public values the environment very highly, its environmental knowledge is very low, even in the Chesapeake area. It therefore becomes important to reduce the technical message to simple elements and to target the communication to those people who need the information.
- Does EPA practice using better science in their decision making today than 20 years ago? EPA uses information better, but still needs to improve how it regulates and manages for multiple and cumulative impacts

## 6. Summary

The MAIA Working Conference presented the results from several of its activities and programs to scientists, environmental managers, and the general public. The attendees provided feedback on the usefulness of the MAIA program's activities, and suggested additional needs and recommended changes for the future. The feedback may be summarized into these five broad recommendations:

- Accelerate interactions with stakeholders through tools such as focus groups, communications workshops, fact sheets, and public-oriented communications.

- Develop a MAIA program web site that is simple, user-friendly, and operationally effective.
- Continue to promote “integrated science,” and develop a five-year plan for integration and assessment that builds upon successes in ecological resource areas (e.g., estuaries, streams, forests, agriculture, and groundwater).
- Incorporate socioeconomic values and benefits, as well as scenarios of future ecological vulnerabilities.
- Develop a common vision for information management in a regional entity that would be larger and more inclusive than the MAIA program’s present geographic initiatives. Form an Executive Coordinating Committee of all MAIA’s geographic initiatives to plan the next steps, identify the stakeholders, and develop a memorandum of understanding.

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